

www.rmotc.com

1.888.599.2200

Casper, WY 82601

Suite 150

907 North Poplar

Center

Oilfield Testing

Mountain

Rocky

PRESORTED  
U.S. POSTAGE  
PAID  
CASPER, WY  
PERMIT NO. 165

## PROJECT BRIEFS

### BP America Expandable Screen Test

The BP America (Schlumberger) expandable screen liner was successfully tested at NPR-3 in late September. This technology was developed primarily as a production liner for wells with sand problems.

### Metal Skin, Test

The BP America (Weatherford Metal Skin) expandable solid liner assembly is already in use throughout the industry in cased-hole applications. The RMOTC test this January was the first deployment under open-hole conditions.

### Carbon Mitigation Initiative (CMI)

RMOTC is currently designing a joint project with the Princeton University Carbon Mitigation Initiative (CMI). The project plans to acquire cement samples from NPR-3 wells for CMI in order to test long-term effects of reservoir fluids and CO<sub>2</sub> on cement integrity.

### Maurer High Pressure Test

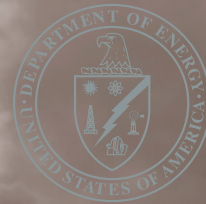
The Maurer high pressure drilling system is scheduled for testing in early March.



# SPRING 2004



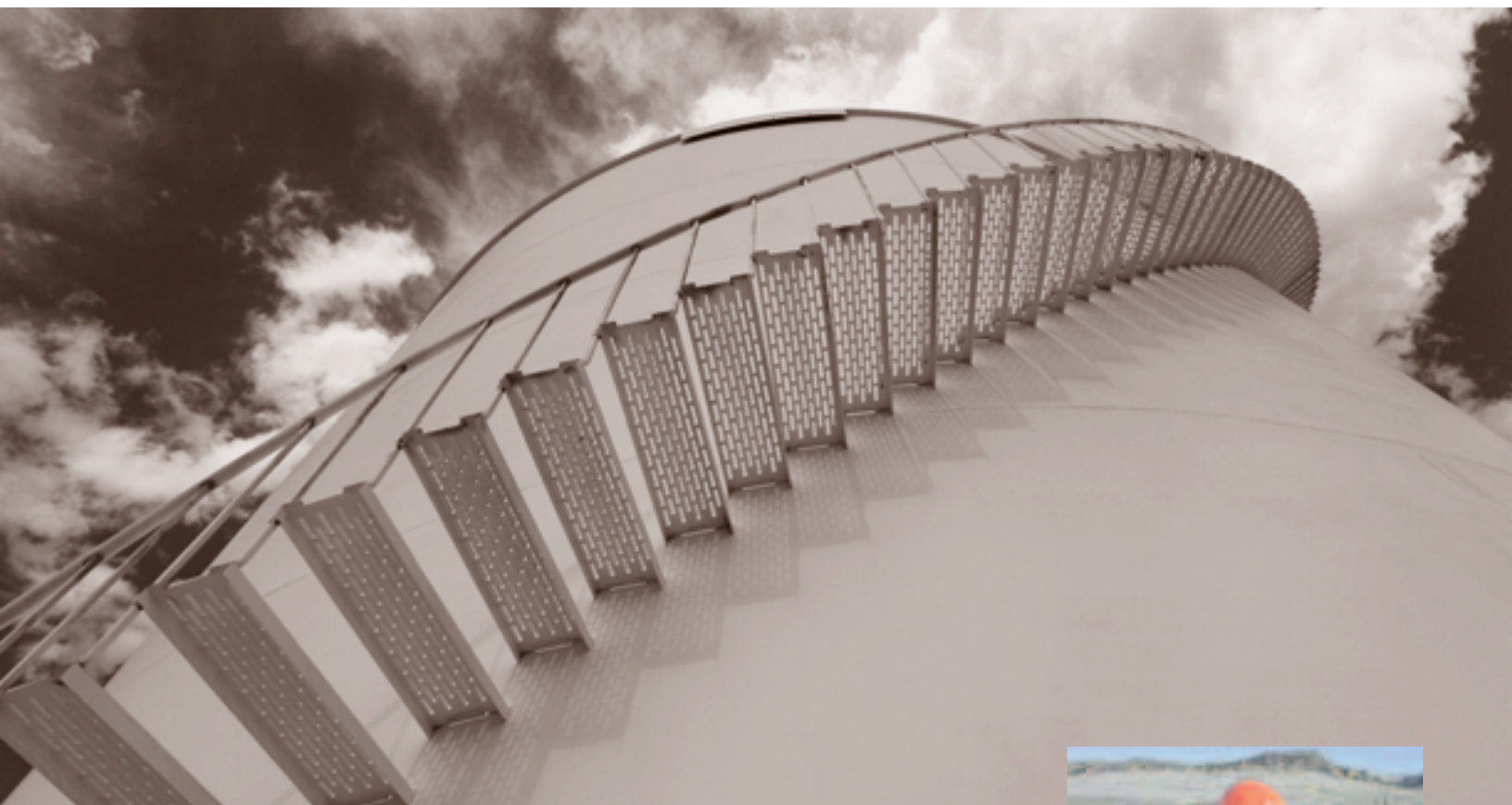
## ROCKY MOUNTAIN OILFIELD TESTING CENTER



Office of Fossil Energy



# RMOTC'S NEW ROLE IN LARGE-SCALE CARBON SEQUESTRATION



PROJECT LEAD: VICKI STAMP

The Rocky Mountain Oilfield Testing Center (RMOTC) is leading an exciting multi-partner scientific project that could potentially result in large-scale carbon sequestration at the Naval Petroleum Reserve No. 3 (NPR-3). Both carbon sequestration and enhanced oil recovery (EOR) technologies are being used in the project, which teams RMOTC with neighboring Anadarko Petroleum Corporation, the operator at Salt Creek, and a diverse group of other technical partners.

RMOTC and Anadarko have agreed to cooperate in ways that are expected to yield important dual assessments: first, on optimal carbon sequestration in depleted oil and gas fields throughout the multi-state Rocky Mountain

Dr. Ron Klusman  
of Colorado School  
of Mines collecting  
soil gas samples



region; and second, on optimizing the combination of sequestration and enhanced recovery. Anadarko has recently initiated a large commercial EOR project that will inject approximately 7,200 tons of carbon dioxide (CO<sub>2</sub>) per day into their declining Salt Creek field, boosting production from 5,300 barrels per day to an estimated gross of between 26,000 and 32,000 barrels per day over

# PSI COST-CUTTING SUBMERSIBLE OIL PUMP

PROJECT LEAD: JOE ROCHELLE

A series of over 20 successful field tests conducted at RMOTC since 2001 show that adaptation of a submersible pump, developed by Pumping Solution, Inc. (PSI), could save as much as 50% in operating costs, allowing marginal fields to remain profitable longer.



PSI, a small startup company located in Albuquerque, NM, developed a new type of submersible pump for operators of marginal wells. The pump, with its self-contained electric motor, is similar to an electric submersible centrifugal pump in

appearance and installation characteristics. Although the pump uses a positive displacement (PD) hydraulic pumping mechanism, it is different from other PD pumps because it is located completely within the well bore and the pump exterior is sealed. This eliminates noise, emissions and hazardous conditions.

In the majority of the installations at RMOTC, the pump's one horsepower, three-phase submersible electric motor uses an average of one kilowatt of power, making it especially suitable for small producers (less than 30 barrels per day). The company has models capable of producing up to 300 barrels per day for coal bed methane as well as other oil and gas applications. This family of pumps produces significant cost savings by reducing electrical usage and lowering installation costs. These cost reductions, combined with environmental

enhancements, make the technology an optimal approach for many marginal producers.

Problems addressed and solved by RMOTC during testing included splicing techniques, diaphragm materials issues, corrosion, and general operating procedures. In addition, RMOTC demonstrated how these pumps can run safely without well bore damage whether run on 2 3/8" tubing or suspended on cable.

PSI is developing several variations of this technology for other applications and continues to receive support from DOE, industry, and the Stripper Well Consortium for future development of this breakthrough technology.

PSI has recently entered into a joint venture with Smith International (NYSE SII) to produce and market pumps for oil, gas, and coal bed methane markets. The new company is named SmithLift™, and will market pumps through the Wilson division of Smith International.

Pumps will be built in the Salt Lake City area utilizing parts from primarily domestic suppliers. ♦



# MICROHOLE OIL FIELD EXPLORATION AND PRODUCTION DEMONSTRATION

PROJECT LEAD: RALPH SCHULTE

**L**os Alamos National Laboratory has partnered with RMOTC to successfully test and demonstrate its coiled tubing Microhole drilling technology. Microholes, because of their small diameter relative to commercial production wells, offer the possibility of significantly improving the recovery of oil from depleted oil reservoirs.

In Phase I, the drilling team successfully demonstrated coiled-tubing-deployed microdrilling in wells as small as 2 1/16-inch in diameter and as deep as 500 feet in soft shale and sandstone formations.

**Systems integration engineering studies as well as laboratory testing and field demonstrations of drilling components and systems supported this development.**

Phase II of the project proposes using a coiled tubing unit and extending the microdrilling capability to depths of 800 feet. Four (or more) instrumentation microwells (Designer Seismic Microholes) will be drilled to support long term seismic monitoring and Vertical Seismic Profile imaging of CO<sub>2</sub> injections. The NPR-3 CO<sub>2</sub> injection project is in the early planning stages.

Research and development of microhole technology benefits both RMOTC and domestic independent producers of oil and gas by providing a cost-effective means for low-volume production from oil and gas reservoirs, as well as an inexpensive exploration tool. ♦





the course of several years. Given the 2.6 million tons of CO<sub>2</sub> the project estimates for sequestration annually (almost 700,000 tons of carbon), and the concurrent rise in related oil production, the potential for this CO<sub>2</sub>/EOR sequestration program is substantial.

As part of the Salt Creek project, Anadarko built a 125-mile pipeline extension in 2003 to bring in by-product CO<sub>2</sub> gas from a natural gas processing plant in western Wyoming. A short spur to deliver CO<sub>2</sub> to NPR-3 is in the planning stages.

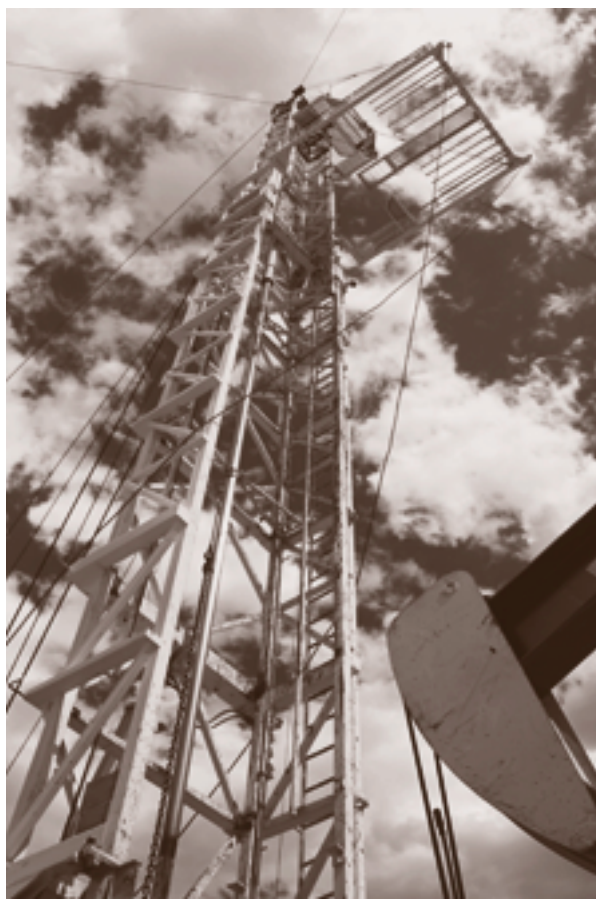
Phase I (conceptual design) of the NPR-3 portion of the project is currently underway, and results of these efforts are being continuously evaluated to determine subsequent steps. The current effort is focused on more fully characterizing NPR-3's reservoirs, determining optimal carbon sequestration levels and the feasibility of enhanced recovery from CO<sub>2</sub> injection. Several data gathering and processing activities are in progress including 1) field work by Lawrence Livermore National Laboratory and RMOTC at Salt Creek testing Electrical Resistance Tomography as a CO<sub>2</sub> monitoring technology in EOR projects, 2) field work at NPR-3 with the Colorado School of Mines performing baseline soil gas and gas flux research, and 3) a fault seal leakage study and geologic description efforts with the University of Maryland and the University of Wyoming.

Injection of CO<sub>2</sub> at NPR-3 could begin as early as 2005 on a small scale, and continue for seven to ten years, depending on Department of Energy (DOE) and partner funding. Sequestration may not only be the single most

important research initiative for the future of coal and other fossil fuels, but it is the only current option for addressing climate change that is completely compatible with the current energy infrastructure. **Both the DOE**

**and RMOTC are approaching carbon sequestration as a research challenge, a way to provide future options for climate change issues while striving to meet the nation's energy needs.** In addition to Anadarko Petroleum, RMOTC's current

partners in this effort are the University of Wyoming, Colorado School of Mines, University of Maryland, BP-CO<sub>2</sub> Capture Project, Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, Idaho National Engineering and Environmental Laboratory, Los Alamos National Laboratory, Princeton University, iReservoir.com, U.S. Geological Survey, Texas A&M University and the University of Colorado. ♦



# VORTEX FLOW TECHNOLOGY TESTED AT NPR-3 INCREASES FLOW EFFICIENCY



PROJECT LEAD: MARK MILLIKEN

**V**ortex Flow, LLC, a company committed to increasing oil and gas well production through the use of innovative technology, has been testing their Vortex Oil and Gas Units at NPR-3 since 2002. This pipeline innovation successfully separates natural gas and liquids flowing within pipe by developing a spiral flow pattern. The pattern generates constant pressure and increases the flow rates of both liquids and gases.

The first test at NPR-3 involved a gas flowline with water condensation present. The unit was installed on a mile-long low-pressure gas gathering line in December 2002. By mid-April 2003 very little liquid could be detected in the flowline. The Vortex unit had proved effective in reducing the amount of stagnant liquids, thus keeping the line from freezing for most of the winter. The line froze on only one occasion, when the temperature dropped to -45°F.



The second NPR-3 test evaluated the unit's efficiency in moving liquid in a short uphill line from a wellhead to the manifold. To date, this unit has been effective in maintaining stable pressure.

The Vortex unit was also successful in reducing paraffin blockage in gathering lines. Before the unit was installed, 1,000 pounds per square inch (psi) of pressure was needed to move hot water through the line, suggesting severe line restriction due to paraffin buildup. In April 2003, nearly 70 days after installation of the unit, pump pressure was tested again and registered 125 psi, consistent with a fully functional, unblocked line. In July 2003 lines were retested producing similar results.

The ability of the unit to mitigate paraffin deposition in gathering lines reduces the risk of line failure and the frequency of line treatments, thus increasing well production and decreasing operating costs. ♦



Vortex unit installed  
in flowline during  
test at NPR-3